QEAFATE Model Development and Application History

QEAFATE Model Development History

QEAFATE is a numerical model that simulates the fate and transport of chemicals in the sediment bed and overlying water column of an aquatic system. QEAFATE was developed by personnel at Quantitative Environmental Analysis, LLC (QEA) in 1998 using the WASTOX model as a starting point. WASTOX was developed by Dr. John Connolly (currently of Anchor QEA) on behalf of USEPA in the 1980s (Connolly and Winfield 1984; Connolly and Thomann 1985). The WASTOX code also formed the basis for the widely used USEPA-supported WASP model (Wool et al. 2008).

Since its development, the QEAFATE code has been continually improved and updated by Anchor QEA (formerly QEA) personnel. The most recent update consisted of transferring the code into the USEPA-supported EFDC hydrodynamic modeling platform[1]. By doing so, QEAFATE is seamlessly linked with Anchor QEA's state-of-the-science sediment transport code, which is based on the SEDZL and SEDZLJ algorithms. In a USEPA evaluation of tools for modeling contaminated sediment sites, an earlier version of QEAFATE received a favorable review (Imhoff et al. 2003).

A review of the state-of-the-science in chemical fate and transport models for contaminated sediment sites indicates that QEAFATE has similar capabilities to other available models in terms of its representation of the major fate and transport processes affecting chemicals within the water column and sediment bed. These other models include the EPA-supported EFDC (with toxics module) and WASP models, as well as the USACE CE-QUAL-ICM/TOXI model.

QEAFATE Application History

The QEAFATE predecessor code (i.e., WASTOX) was applied at many sites, including PCBs in the Great Lakes (e.g., Thomann et al. 1987), PCBs and PAHs in the Detroit River, MI, metals and organics in the Pawtuxet River, RI, and mercury in Lavaca Bay, TX (HydroQual 1998). The table below provides a listing of select sites where the QEAFATE model has recently been applied with some level of agency review and acceptance:

[1] http://www.epa.gov/athens/research/modeling/efdc.html

Site	Application Type			Citations
	Fate & Transport Evaluation	Remedial Alternative Evaluation	Remedial Design Support	
Hudson River, NY, PCBs	X	X	X	• QEA 1999 • Connolly et al. 1999 • Zahakos et al. 1999 • Connolly et al. 2000 • Israelsson et al. 2001 • QEA 2005 • Zahakos 2005
Grasse River, NY, PCBs	X	X	X	• Alcoa 2001 • Alcoa 2002 • Alcoa 2003
Housatonic River, CT, PCBs [1]		X		• ARCADIS and QEA 2008
Neal's Landfill Site (Conard's Branch and Richland Creek), IN, PCBs	X	X [2]		• Russell et al. 2006 • QEA 2007 • USEPA 2007 • Russell et al. 2009

Notes
[1] Model applied for sediment bed only; currently under review by USEPA.
[2] At this site, model predictions factored heavily in the remedy selected by USEPA.

EPA Applications of Chemical Fate and Transport Models

EPA has applied model frameworks that are similar in structure and function to QEAFATE as part of its assessments at several contaminated sediment sites. While not the same model code as QEAFATE (although WASP-based applications do share the same lineage), such applications demonstrate a similar approach to evaluating remedial alternatives. Examples include:

- Hudson River, NY (www.epa.gov/hudson/study.htm)
- Housatonic River, MA (http://www.epa.gov/region01/ge/thesite/restofriver-reports.html#Modeling)
- Fox River, WI (http://www.dnr.state.wi.us/org/water/wm/FoxRiver/finalmodel.html)
- Passaic River, NJ (www.ourpassaic.org/projectsites/premis_public/index.cfm?fuseaction=Modeling)
- New Bedford Harbor, MA (http://www.epa.gov/NE/nbh/techdocs.html#FeasibilityStudiesModelingStudiesRiskAssessments)
- Various Great Lakes Areas of Concern (www.epa.gov/glnpo/aoc/index.html)

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